

GROWTH PROMOTING
PHARMACEUTICAL IMPLANT

1 The present invention is broadly concerned with a
2 pellet implant system that administers a growth stimulating
3 pharmaceutical pellet dosage in combination with a
4 parasitocidal, antimicrobial, estrus suppressant and/or
5 other supplemental pellet dosage subcutaneously in a single
6 procedure in order to promote physiological growth which is
7 synergistically augmented and promoted by control of
8 parasites, microbes and/or estrus and the like.

9 More particularly, it is concerned with an implantation
10 device having a pellet magazine containing pellets having a
11 growth stimulating pharmaceutical in combination with a
12 parasiticide, an antimicrobial agent and/or an estrus
13 suppressant or other supplemental agent in a growth
14 promoting combination as well as an injection needle and
15 structure permitting injection of the pellets from the
16 magazine through the needle for implantation under the skin
17 of an animal. The pellets are formulated to simultaneously

1 deliver doses of the various components that are released in
2 the body of the animal according to a predetermined
3 schedule.

4 Subcutaneous implantation of pharmaceutical
5 compositions and medical devices has been widely adopted for
6 therapeutic, health and growth enhancement purposes for
7 livestock and companion animals, humans and even certain
8 wild animals, such as those maintained in parks and zoos.
9 Various growth promotants are employed to foster improved
10 growth and enhanced body weight in livestock animal species
11 such as cattle, swine, sheep, poultry and the like.

12 Broad spectrum endectocides, that is, pharmaceutical
13 compositions which control both internal and external
14 parasites, are now available to control the numerous members
15 of the Arthropoda and Nematoda phyla, such as flies,
16 mosquitoes, midges, keds, lice, maggots, mites, ticks, and
17 their larvae, worms, wasps, and predaceous beetles and have
18 been applied to animals in various ways. Antimicrobials
19 have been employed for prophylactic as well as acute
20 treatment of respiratory and other bacterial diseases.
21 Estrus suppressors are used to maintain appetite and
22 enhance growth, especially in cattle.

23 These compounds have been employed for various purposes
24 to effect the health of animal populations, as well as

1 production, performance and reproductive efficiency. Some of
2 these compounds also relieve discomfort which may accompany
3 pest infestation and infection. Other types of biologically
4 active compounds, including vitamins, anti-inflammatory
5 agents, vaccines and biocides are also commonly used to
6 improve the health status of animal populations.

7 Some of these compositions are implantable in animals,
8 such implantable compositions are often administered as
9 solid compressed pellets which are injected by an implanter
10 equipped with a hypodermic needle. In livestock implants
11 are normally made in the ear or in other areas of the animal
12 that are not for consumption and are discarded. The
13 implanter needle is used to make a small self-sealing and
14 noncoring implant-receiving puncture beneath the skin at a
15 suitable location on the body of the animal. Small pellets
16 of a bioactive composition are forced through the needle and
17 left under the skin as the needle is removed.

The pellets are normally implanted in non-poultry livestock animals while the animal is confined in a squeeze chute. Using head restraint, an ear is grasped in one hand, and an implanter device having a large hypodermic needle is used to puncture the hide and subcutaneously inject a pellet dose into an implant-receiving puncture. Implantation must be performed carefully to ensure that the pellets are placed

1 properly and that no portion of the pellet remains extending
2 from the puncture outside the hide. The procedure must also
3 be performed quickly, since the animals are not entirely
4 cooperative and may shake their heads to free the held ear.

5 U.S. Patent No. 5,522,797 and entitled Slide Action
6 Veterinary Implanter, is directed to an implanter of the
7 type described above and is hereby incorporated by
8 reference. This patent discloses an implanter which
9 employs a slide action mechanism to retract an impeller,
10 store an impeller driving force in a spring in cooperation
11 with a latch mechanism, reset a trigger, and advance a
12 pellet magazine, all by a single trigger actuated
13 reciprocation of the slide mechanism. Operation of the
14 trigger also forces the pellets from the magazine through
15 the needle and under the skin of the animal.

16 Efficient implanters, such as that taught in the above
17 noted patent and other patents to similar implanters, permit
18 rapid sequential injection of many animals in a single
19 session and make implant technology particularly well-suited
20 for administration of bioactive compositions, while the
21 animals are confined for ear tagging, branding, veterinary
22 procedures or the like. Even where only a single animal is
23 to be treated, implantation offers a particularly safe
24 method for administering certain compositions, so as to

1 allow a user to avoid compounds that could be toxic if
2 ingested by the animal, for example by licking residue left
3 on the hide or fur, or on that of another animal following
4 treatment by dipping, spraying or dusting.

5 Physiological growth and weight gain in particular are
6 of primary importance in livestock animals raised for meat.
7 Parasite control has long been a primary goal of animal
8 husbandry. A number of effective endectocides and insect
9 growth regulators are available for control of arthropod and
10 nematode parasites, including the polyketide avermectins,
11 the milbemycins and milbemycin oximes, fenbendazole,
12 pyriproxyfen and lufenuron, diflubenzuron, methoprene, ethyl
13 carbamate and fenoxycarb. The most commonly used
14 avermectins are ivermectin, doramectin, moxidectin,
15 eprinomectrin and abamectin. U.S. Patent Application Serial
16 Number 09/163,646, now Patent No. _____ for
17 Pellet Implant System for Immediate and delayed Release of
18 Antiparasitic Drug, which is incorporated herein by
19 reference, discloses a system which delivers subcutaneously
20 pellet implants of varying controlled release parasiticide
21 dosages to provide immediate as well as sustained release of
22 the parasiticide for a period of up to several months
23 without redosing.

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1 Respiratory disease and its consequent growth
2 impairment is a particular problem among crowded animals,
3 such as is found in feedlots. Suitable antimicrobial
4 compositions include tylosin tartrate, tylosin,
5 oxytetracycline, tilmicosin phosphate, ceftiofur
6 hydrochloride, ceftiofur sodium, and sulfadimethoxine.
7 Prophylactic administration of these antibiotics permits
8 usage of lower doses than those required to treat an
9 infected animal.

10 Similarly, estrus-induced appetite inhibition in food
11 animals diminishes weight gain. Effective growth promoting
12 pharmaceutical compositions are available, including the
13 progestins, estradiol and its derivatives, trenbolone
14 acetate, testosterone and zeranol. Somatotropins and
15 gonadotropins are also used for various purposes in
16 livestock.

17 It has been noted in accordance with the present
18 invention that administration of a growth stimulating
19 composition in association with effective control of
20 internal and external parasites results in a highly
21 effective growth promoting composition and an augmentation
22 of the physiological growth of the animal. In certain
23 circumstances, the animals may even gain significantly more
24 weight than is predicted from summation of the predicted

1 effects of the individual compounds, as there is a
2 synergistic effect associated with combining the various
3 compositions and implanting them together. Accordingly,
4 there is a need for a system which delivers subcutaneously
5 pellet implants of both a growth stimulating pharmaceutical
6 dosage in combination with a parasitocidal dosage, an
7 antimicrobial dosage, an estrus suppressant dosage and/or
8 other supplemental agents to provide control of parasites,
9 microbial infection, estrus and maximize promotion of
10 growth.

11
12 Summary of the Invention

13 The present invention provides a greatly improved
14 pharmaceutical implant system which simultaneously delivers
15 separate doses of both a growth stimulating pharmaceutical
16 agent and a second component chosen from a group including
17 parasitocides, antibiotics, estrus suppressors somatotropins
18 and/or gonadotropins into an animal as part of a single
19 procedure wherein the doses preferably have a synergistic
20 augmentative effect on physiological growth and weight gain.

21 Broadly speaking, the implant system includes an
22 implanter apparatus for subcutaneously implanting growth
23 promoting pharmaceutical solid implants, especially in the
24 form of pellets, into an animal through the bore of a

1 hypodermic needle which is operably coupled with a pellet
2 magazine, and one or a plurality of pellets sized to be
3 implanted through the needle and positioned in the magazine
4 for selective sequential alignment of the implant with the
5 needle.

6 The pellets include at least one growth stimulating
7 pharmaceutical agent dose and at least one supplemental
8 agent dose, especially chosen from the group comprising
9 parasiticides, antibiotics and estrus suppressors, as well
10 as other supplemental agents. Each of the pellets may
11 include a single component or the pellets may each contain a
12 mixture of two or more of the agents. A complete set of the
13 pellets is packaged in a stack in the magazine in an
14 individual dosing chamber for simultaneously delivery of the
15 supplemental agents and the growth stimulating
16 pharmaceutical as part of a single injection.

17 Advantageously, the system permits the pellet doses to
18 be formulated for both immediate and controlled, sustained
19 release of an effective dose of the growth stimulating
20 pharmaceutical agent and each of the supplemental agents.
21 The immediate and sustained release doses may be the same or
22 different growth stimulating and supplemental agents, with
23 the principal difference being that different pellet
24 excipients are employed to reduce or lengthen the dose

1 delivery period. Preferably, the delivery rates of the
2 doses are correlated so that combined doses of each of the
3 growth stimulating agent and the supplemental agent are
4 delivered simultaneously both immediately and over a
5 sustained release period of time to produce a highly
6 efficacious, synergistic and long lasting growth promoting
7 combination.

8
9 Objects and Advantages of the Invention

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11 Therefore, the principal objects and advantages of the
12 present invention are: to provide an animal growth promoting
13 composition having in combination a growth stimulating
14 pharmaceutical agent and at least one supplemental agent
15 selected from parasiticides, antimicrobials, estrus
16 suppressing compositions, somatotropins, gonadotropins and
17 other agents that enhance the effect of the growth
18 stimulating agents; to provide such a composition having a
19 pellet system for the implantation in an animal; to provide
20 such a composition having immediate as well as sustained
21 delivery of both a growth stimulating pharmaceutical agent
22 and at least one supplemental agent in order to
23 synergistically promote physiological growth of an animal;
24 to provide such a system which includes an implanter

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1 apparatus for subcutaneously injecting pellets in an animal
2 through the bore of a hypodermic needle which is operably
3 coupled with a pellet magazine and simultaneously introduces
4 both growth stimulating pharmaceutical and supplemental
5 agent doses that are contained in separate or common
6 pellets; to provide such a system and method which permits
7 injection of predetermined doses in a solid bio-erodible and
8 subsequent system absorbable form of each of a growth
9 stimulating pharmaceutical and a supplemental agent in a
10 single injection; to provide such a system and method which
11 permits subcutaneous injection of both the growth
12 stimulating pharmaceutical dose and the supplemental agent
13 dose; to provide such a system and method which permits
14 serial injection of large numbers of animals in a single
15 session; to provide such a system and method which may
16 employ a wide range of growth stimulating pharmaceutical
17 agents for use in growth promotion; to provide such a system
18 and method which is simple and efficient and economical to
19 manufacture, which effectively promotes enhanced growth of
20 the animal and which is particularly well-adapted for its
21 intended purpose.

22 Other objects and advantages of this invention will
23 become apparent from the following description taken in
24 conjunction with the accompanying drawings wherein are set

1 forth, by way of illustration and example, certain
2 embodiments of this invention.

3 The drawings constitute a part of this specification
4 and include exemplary embodiments of the present invention
5 and illustrate various objects and features thereof.

6

7 Brief Description of the Drawings

8

9 Figure 1 is a fragmentary perspective view of a cow, an
10 implanter apparatus with implants in accordance with the
11 present invention and an apparatus operator.

12 Figure 2 is an enlarged, fragmentary side elevational
13 view of the cow and implanter apparatus illustrating a
14 hypodermic needle of the implanter with implant pellets
15 inside the needle being inserted into an ear of the cow,
16 with portions broken away to show working detail.

17 Figure 3 is an enlarged, fragmentary side elevational
18 view of the cow and implanter apparatus similar to Fig. 2,
19 illustrating subcutaneous placement of a stack of pellets by
20 the implanter into the ear of the cow, with portions broken
21 away to show working detail.

22

23

1 Detailed Description of the Invention

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3 As required, detailed embodiments of the present
4 invention are disclosed herein; however, it is to be
5 understood that the disclosed embodiments are merely
6 exemplary of the invention, which may be embodied in various
7 forms. Therefore, specific structural and functional
8 details disclosed herein are not to be interpreted as
9 limiting, but merely as a basis for the claims and as a
10 representative basis for teaching one skilled in the art to
11 variously employ the present invention in virtually any
12 appropriately detailed structure.

13 The reference numeral 10 represents a pellet
14 implantation system in accordance with the invention. The
15 implantation system 10 broadly includes a slide action
16 implanter apparatus 12 which is used to implant solid form
17 bioactive compounds or implants 13 having various
18 formulations in accordance with the invention, including a
19 growth stimulating pharmaceutical agent compressed in a
20 first pellet 14, a parasitocidal agent compressed in a
21 second pellet 15, an immediate release antimicrobial agent
22 in a third pellet 16, a delayed release antimicrobial agent
23 in a fourth pellet 17 and an estrus suppressing agent in a
24 fifth pellet 18. The pellets 14 through 18 are included in

1 stacks in a magazine strip 19 and injected into an animal 20
2 through a hypodermic needle 22. The needle 22 is utilized
3 by an operator 24 to create a hide opening 26 that produces
4 an implant-receiving puncture 28 in the animal 20.

5 Different types of implanters may be used with the
6 invention and a suitable implanter apparatus is illustrated
7 and described in detail in the 5,522,797 patent. The
8 implanter apparatus 12 generally includes a housing 30
9 having a finger grip 32 with a trigger assembly 34 pivotally
10 mounted therein. An impeller 36 is slidably mounted within
11 the housing 30 in alignment with an interior bore 38 of the
12 needle 22 and aligned chambers 40 of the loaded pellet
13 magazine strip 19. The needle 22 is used to puncture
14 through skin or hide 42 of an animal's ear 44 at the opening
15 26, and the trigger 34 is squeezed toward the grip 32 of the
16 housing 30 to initiate injection of the pellets 14 through
17 18 by urging the impeller 36 through the magazine chamber 40
18 and needle bore 38, thereby forcing the pellets 14 to 18
19 through the bore 38 of needle 22 and into the puncture 28 in
20 the ear 44.

21 Each magazine strip 19 of the implanter 12 typically
22 contains multiple parallel aligned implants 13 that contain
23 stacks of pellets stored in corresponding pellet chambers
24 40, which are interconnected by webs 46. The chambers 40

1 are slightly conical in shape and are arranged in side-by-
2 side parallel relation. The chambers 40 may have internal
3 frictional formations such as beads or posts (not shown) to
4 retain the pellets 14 through 18 therein prior to insertion
5 and such beads can be easily overcome and bypassed by
6 application of pressure to the trigger 34. A plurality of
7 strips 19 can be connected in end-to-end relation to
8 increase the implanting capacity before the implanter 12
9 requires reloading. When the pellets 14 through 18 in an
10 individual magazine strip 19 are exhausted, the empty strip
11 19 can be detached from the remaining strips 19 located in
12 the implanter 12 and discarded.

13 In the present embodiment, each pellet chamber 40 is
14 loaded with one or more growth stimulating pharmaceutical
15 agent dose pellet 14 and one or more supplemental agent
16 pellet, here pellets 15 to 18. The pellets 14 through 18
17 each include an effective amount of one or more of the
18 agents, formed into a compressed pellet in conjunction with
19 one or more excipients so as to form either an immediate or
20 a delayed release pellet.

21 In accordance with the invention the pellets 14 to 18
22 include at least one growth stimulating agent and at least
23 one supplemental agent that cooperatively works with the
24 growth stimulating agent to promote growth in the animal, as

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1 a growth promoting combination. The supplemental agent is
2 preferably a combination of an immediate release and quick
3 acting parasiticide to immediately rid the animal of
4 infestation by pests and a long term release and delayed
5 acting parasiticide to maintain the animal free of
6 infestation of pests over a substantial period of time, both
7 immediate release and long term release antibiotics to keep
8 the animal free of microbial infection and an estrus
9 suppressing composition to keep the animal from entering
10 estrus.

11 In accordance with the invention it is possible that
12 one or more growth stimulating agents and one or more
13 supplemental agents could be mixed together and incorporated
14 in a single pellet; however, because each of the agents may
15 be absorbed at different rates or require different
16 carriers, normally there will be a different pellet, such as
17 pellets 14 through 18 for each of the agents. Therefore,
18 while it is seen to be preferable to have individual pellets
19 for each of the different agents, it is well within the
20 scope of the invention to have a single elongate or multiple
21 shorter pellets with mixtures of two or more agents or to
22 have some agents in separate pellets injected with other
23 agents that are mixed and formed into a common pellet.

1 A wide range of active ingredients may be employed as
2 growth stimulating pharmaceutical agents, for example the
3 progesterone, estradiol and derivatives thereof including
4 estradiol benzoate, trenbolone acetate, testosterone
5 propionate and zeranol. As used herein, the term growth
6 stimulating pharmaceutical agent is intended to include such
7 agents as noted above and other compositions that operably
8 function under the present invention to promote
9 physiological growth and which may be used internally in the
10 particular species of animal to be treated by the invention.

11 A wide range of active ingredients may be employed as
12 parasiticidal agents, for example, the polyketide
13 avermectins, such as ivermectin, doramectin, moxidectin,
14 eprinomectrin and abamectin, the milbemycons and milbemycin
15 oximes, fenbendazole, oxfendazole and lufenuron. As used
16 herein the term parasiticide is intended to include
17 parasiticides as noted above and other compositions that
18 operably function under the present invention as
19 parasiticides in combating infestation and preventing
20 reinfestation by internal and external parasites and which
21 may be used internally in the particular species of animal
22 to be treated by the invention.

23 It is noted that the amount of growth stimulating
24 pharmaceutical agent or supplemental agent required to

1 produce the desired treatment varies with respect to the
2 species and size of the animal to be treated.

3 For example, in pasture cattle the growth stimulating
4 agent may be estradiol benzoate in a range from 5 to 50
5 milligrams per implant, preferably within the range of 10 to
6 30 milligrams and most preferred with a dosage of 20
7 milligrams. For pasture or feedlot heifers the growth
8 stimulating agent may be trenbolone acetate in a range of 20
9 to 400 milligrams per implant, preferably in a range of 40
10 to 100 milligrams for pasture heifers and 150 to 250
11 milligrams for feedlot heifers. For the cattle entering a
12 feed yard the growth stimulating agent may be estradiol in a
13 range from 5 to 50 milligrams per implant, with a preferred
14 range of 15 to 30 milligrams and a most preferred dosage of
15 25 milligrams.

16 Further for example, when treating cattle, an immediate
17 release parasiticide pellet for control of insects,
18 arachnids, especially ticks and nematodes, preferably
19 contains between about 25 and 125 milligrams of ivermectin
20 and the sustained released combined parasiticide pellets
21 contain between about 50 and 175 milligrams of ivermectin.
22 Parasiticide agents having extended circulatory half-lives,
23 such as ivermectin, are particularly preferred. A
24 parasiticide pellet formulation may include ivermectin in a

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1 agents at complementary different rates and so that the
2 animal also preferably receives both immediate and extended
3 release doses of each of the agents. Pellets formulated for
4 extended release combine an effective dose of a supplemental
5 agent such as the parasiticide ivermectin or a growth
6 stimulating pharmaceutical agent such as progesterone with
7 binding agent excipients that lengthen the implant delivery
8 period by extending the integrity of the pellet and limiting
9 the hydration of the pellet by extracellular fluid entry
10 into the pellet. In this manner, the extended
11 pharmacokinetics of the agent, delayed bio-erosion of the
12 pellet, and delayed diffusion of the agent dose into the
13 animal's circulatory system cooperatively result in an
14 extended release dosage which makes available for absorption
15 an effective dose of the agent over a period of months, for
16 example 150 days.

17 Any of a number of excipients may be employed in the
18 extended release pellets, including lactose, polyethylene
19 glycol, as sold under the trademark Carbowax® by Union
20 Carbide, cholesterol magnesium stearate, cellulose and its
21 derivatives, especially ethylcellulose as sold under the
22 trademark Ethocel® by Dow, povidone, crospovidone,
23 croscarmellose, dicalcium phosphate, polymeric supports,
24 binders and coloring agents.

1 The immediate release pellets make the agent available
2 for absorption into the bloodstream of the animal
3 immediately (normally within hours or a few days) and may
4 include the previously listed excipients as well as
5 disintegration aids such as magnesium stearate and
6 croscarmellose sodium, especially as sold under the
7 trademark Ac-Di-Sol® by FMC and microcrystalline cellulose,
8 especially as sold under the trademark Avicell® by FMC.

9 Each immediate release pellet is formulated to dissolve
10 and enter the animal's blood system (systemically) within a
11 few days, preferably within hours of injection. The
12 extended release pellets are formulated to release active
13 agent into the animal's blood system slowly and continuously
14 over a period of many days, for example about 150 days, in
15 order to sustain a sufficient level of the agent
16 systemically in the animal being treated to effect the
17 desired result of the agent.

18 The compressed pellets 14 through 18 can be produced
19 inexpensively and in large quantities by a variety of
20 conventional manufacturing equipment.

21 In the illustrated embodiment, a first pellet 14 has a
22 growth stimulating pharmaceutical agent dose of estradiol
23 benzoate, a second pellet 15 includes an immediate release
24 dosage of the parasiticide ivermectin, a third pellet 16

1 includes a delayed release dosage of the parasiticide
2 ivermectin, a fourth pellet 17 includes an estrus
3 suppressing dosage of melengestrol acetate and a fifth
4 pellet 18 has an antimicrobial dosage of tilmicosin
5 phosphate, although it is foreseen that other combinations
6 including fewer or more agents are possible within the scope
7 of the invention. It is foreseen that the number of pellets
8 within an individual dosing chamber 40 within a magazine 19
9 for each release formulation within may vary, depending on
10 the desired dose of growth promoting agent and parasiticide
11 to be delivered. As an example, the pellets 14 through 18
12 may in some instances be combined as a single pellet or may
13 have many pellets.

14 Each magazine chamber 40 is prefilled with a preferred
15 number of discrete pellets 14 through 18, each containing
16 respectively a growth stimulating pharmaceutical agent
17 and/or a supplemental agent dose in a compressed pellet
18 formulation which may be designed for immediate or extended
19 release or a combination thereof, the chamber 40 has at
20 least one pellet 14 including a growth stimulating
21 pharmaceutical agent dose and one or more pellets 14 through
22 18 including one or more supplemental agents.

23 In use, an operator grasps the implanter 12 by the grip
24 32 and urges the needle 22 into the hide 42 and under the

1 skin of the target animal 20 to make the implant receiving
2 puncture 28. The puncture 28 shown in Fig. 2, is
3 approximately half complete and is complete in Fig. 3. The
4 operator 24 depresses the trigger member 34, thereby
5 propelling a pin 48 of the impeller member 36 forwardly
6 through an aligned magazine chamber 40, forcing the pellets
7 14 through 18 through the needle bore 38 and into the
8 implant receiving puncture 28. The operator 24 then
9 withdraws the needle 22, leaving the pellets 14 through 18
10 in the implant receiving puncture 28.

11 Where immediate and delayed release agents are utilized
12 the bioerodible excipient and disintegration aids included
13 in the formulation of the immediate release agents make
14 those agents immediately available for systemic absorption
15 an effective dose of the agent or agents typically for up to
16 30 days. The binders included in the extended release
17 pellets cause delayed bioerosion of the pellets and
18 diffusion of the effective dose of the agents therein for
19 absorption into the bloodstream of the animal over an
20 additional period of up to 120 days. This multicomponent
21 formulation lengthens the pellet delivery period for the
22 agent doses so that effective blood levels of the agents are
23 maintained for periods of up to about 150 days.

1 Advantageously, the magazine strip 19 may be loaded for
2 selective injection of any number of growth stimulating
3 pharmaceutical pellets 14 or immediate release or extended
4 release supplemental agent pellets, such as pellets 15 to 18
5 in order to obtain delivery of a selected dosage by each
6 formulation of agent tailored to the species, weight, age or
7 sex in a wide variety of animals. Where a number of pellets
8 of each formulation of pellets of a single or multiple agent
9 are to be delivered, the pellets may be alternated. In
10 other embodiments, the pellets 14 through 18 may be
11 alternated or varied with respect to the incorporated agents
12 in a stack of pellets of other pharmaceuticals, for delivery
13 through the implant receiving puncture 28.

14 The pellet system 10 of the present invention may be
15 employed efficaciously with cows, sheep, swine, goats,
16 poultry, horses, dogs, cats or any other suitable animal,
17 including wild animals and humans.

18 The following example is provided for the purpose of
19 illustrating the invention and is not intended to be
20 limiting upon the scope of the claims.

21 EXAMPLE I

22 An implant is produced of multiple pellets sized,
23 shaped and numbered to fit as a stack in a single bore of a
24 pellet magazine of an implanter. The pellets include six

